Human-Computer Interaction and Information Management (HCI&IM)

NITRD Agencies: NSF, DoD Service research organizations, NIH, DARPA, NASA, AHRQ, NIST, NOAA, EPA
Other Participants: GSA, NARA

HCI&IM R&D aims to increase the benefit of computer technologies to humans, particularly the science and engineering R&D community. To that end, HCI&IM R&D invests in technologies for mapping human knowledge into computing systems, communications networks, and information systems and back to human beings, for human analysis, understanding, and use. R&D areas include: cognitive systems, data analysis in fields such as human health and the environment, information integration, multimodal and automated language translation, robotics, and user interaction technologies.

Highlights of the President's 2007 Request

Strategic Priorities Underlying This Request

HCI&IM capabilities support key national priorities including large-scale scientific research, national defense, homeland security, air-traffic control, emergency planning and response, health care, space exploration, weather forecasting, and climate prediction. To advance these priorities, HCI&IM R&D is needed in:

Information accessibility, integration, and management: Next-generation methods, tools, and technologies to make it possible to access, integrate, analyze, and efficiently manage massive stores of widely distributed, heterogeneous information (e.g., science and engineering research data, Federal records). These capabilities will help human analysts make better use of all available information resources in the pursuit of new knowledge. The initial focus is on domain-specific collections, with the long-term goal of developing techniques that can be generalized across domains. Needs also include:
- **– Federal information management architecture testbeds:** To evaluate issues in petascale collections of information governed by differing requirements (e.g., national security, personal privacy)
- **– Long-term preservation:** Maintenance of and access to long-lived science and engineering data collections and Federal records

Multimodal devices and interfaces: Human-computer interaction capabilities enabling rapid, easy access (e.g., without a keyboard) to and communication and understanding of heterogeneous information (e.g., audio and text in diverse languages, video, images) for national security applications as well as for assistive devices

Systems that know what they are doing: Cognitive systems able to "learn," adjust to change, and repair themselves, to enhance battlefield capabilities, overall system security, and deployability of robotic devices in emergency-response and hazardous environments

Highlights of Request

Cognitive systems: Continue programs in learning, reasoning, and integrated cognitive systems – DARPA

Global Autonomous Language Exploitation (GALE): New program expanding on Translingual Information Detection, Extraction, and Summarization (TIDES) effort, to reduce the need for linguists and analysts by automatically and rapidly providing translated, distilled information that is relevant and useful to military personnel – DARPA, with NSA, NIST, DLI, CENTCOM, other agencies

Multimodal language recognition and translation: Improved performance and evaluation of human language technologies, including speech-to-text, text retrieval, document summarization, automatic content extraction, speaker and language recognition, dialogue and conversation understanding and summarization, meeting room transcription and summarization, question answering, and machine translation; interactive systems, multimodal user interfaces, and usability – DARPA, NSA, NSF, NIST, DTO, with NARA, other agencies

Data security and data analysis methods: New focus on information privacy and security; research in analysis of digital images and videos; research in methods for computational analysis of data collected in the observational sciences; Office of Cyberinfrastructure strategic plan component for sharing science and engineering data – NSF

Data-intensive discovery and design environments: Interdisciplinary team environments leveraging hyperwalls (wall-size high-resolution tiled display systems) for terascale/petascale data exploration, analysis, and understanding, including concurrent visualization (e.g., real-time rendering, computational steering, and remote access to ongoing computations) and algorithms and tools – NASA

Remote Sensing Information Gateway: Global Earth Observation Systems of Systems (GEOSS) demonstration project to share and integrate Earth observational data with initial applications to support air quality goals – EPA, with NASA, NIH, NOAA

Text Retrieval Conference (TREC): Continue evaluations of information-discovery technologies with tracks on Web retrieval, retrieval of documents for genomics research, question answering, personalized retrieval, and a new legal track – DTO, NIST, NSF, with NARA

Planning and Coordination Supporting Request

National workshop on information integration R&D: Identify key issues for coordinated research such as interoperability, privacy, security, and standards to advance utility of heterogeneous, multimodal information environments – NSF, AHRQ, DoD (ONR), EPA, NARA, with NIST, GSA, other HCI&IM agencies

Drug information and standards: Build system to obtain drug information with standardized definitions and in standardized formats from manufacturers, approve and transmit the information to Federal Web sites, including mapping clinical vocabularies and coding systems to clinical reference terminology adopted by HHS, VA, and DoD, and metadata registry of data standards terms – AHRQ, NIH, NIST, FDA, HHS (CMS), other agencies

Earth System Modeling Framework: Information interoperability and reuse in Earth science applications – NASA, DOE/SC, NOAA, NSF, OSD and DoD Service research organizations, other agencies

Eco-Informatics: Workshop and plans for possible second joint solicitation – NSF, NASA, EPA, other agencies

Health informatics: Planning for collaboration to include workshop(s), joint program – NSF, NIH

Additional 2006 and 2007 Activities by Agency

NSF: University-based research in science and engineering informatics; information integration; data mining, information retrieval; knowledge management; human-computer interaction, universal access, digital government; intelligent robots, machine vision technologies; automatic multilingual speech-recognition toolkits

DoD (ONR): New program in human-robot interaction and collaboration; continue programs in persistent surveillance including autonomous systems (e.g., robots, unattended vehicles) and information exploitation; information integration including multiple sources, disparate data types, and shared analysis tools; human factors and organizational design; portable bi-directional language translator

NIH: Curation and analysis of massive biomedical and clinical research data collections; tools to manage and use new databases; tools for building, integrating ontologies; software tools for visualizing complex datasets; curation tools; build nationwide support for standard vocabularies; information integration

NASA: Continue efforts on agency-wide data exploration architecture with centralized data repository; mobile autonomous robots and intelligent systems; speech-based human-computer interaction; wind down space exploration systems projects, including team-centered virtual adaptive automation, automated design of spacecraft systems, some robotics applications, and decision support system for health management

AHRQ: Continue health IT patient safety/quality improvement program including focus on reducing medical errors in ambulatory care settings and promoting safe use of medications, personal safety, and care delivery that achieves the highest-quality outcome; patient safety health-care IT data standards program; and rural/non-rural/regional projects including health information exchange and state information networks

NIST: Evaluation and standards for biometrics including fingerprint, face recognition, multimodal biometrics for identification and verification; evaluation methodology for multimedia, including video retrieval, motion image quality, video analysis, and content extraction and standards for multimedia (MPEG-7, JPEG); usability of interactive systems and user interfaces for mobile robots, human-robot interaction (HRI); usability and accessibility of voting systems; standards for software usability reporting, IT accessibility; measuring performance of smart systems; ontologies for information integration in manufacturing, commerce; developments in the semantic Web and health-care informatics

NOAA: Technologies for disseminating weather and climate data in multiple formats to professionals, academia, and the public; management of very large datasets, use of metadata, and development of decision support tools for knowledge discovery and data display

EPA: Tools and approaches exploring potential linkages between air quality and human health; integration of search and retrieval techniques across environmental and health libraries; evaluation and investigation of the distribution, integration, management, and archiving of models and datasets

NARA: Advance decision support technologies contributing to high-confidence processing of large collections (e.g., collections of Presidential records)